

DSN Telemetry System—Network Control Telemetry Subsystem

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This article describes the real-time cathode ray tube displays which are now generated in the Network Operations Control Center. These displays are derived from received telemetry data and give a continuous update on the status of the DSN Telemetry System and the detailed parameters for any selected stream.

I. Introduction

A real-time monitoring capability has been implemented into the DSN Telemetry System to allow controllers and analysts to monitor the performance of telemetry receiving and processing equipment in the Deep Space Network. This real-time monitor is part of the Network Control Telemetry Subsystem and is implemented as part of the Network Control System Project.

The monitoring is performed by a MODCOMP II computer, located in the basement of Building 230 at JPL, Pasadena. This computer is connected via a Star Switch Controller to the Network Communications Processor. All telemetry high-speed data blocks are routed to the Telemetry Processor. The subsystem thus provides monitoring of all telemetry data sent from any Deep Space Station to the Mission Control Center via high-speed data lines. The MODCOMP II computer is

equipped with 64K words of memory, two disk drives, two cathode ray tube (CRT)/keyboard terminals, and one keyboard character printer terminal. Additional CRT displays are slaved to the two CRT/keyboard units. The terminal and display equipment is located in the Network Operations Control Area for use by network controllers and analysts.

The processor can handle and display data from up to eight telemetry streams simultaneously. The presence of additional streams is indicated; the operator can select or delete the additional streams as desired. Two displays are generated: telemetry status and telemetry analysis. The content and format are described below. Data for these two formats are generated automatically and continuously. Either can be called up on any CRT device by the operator. The operator can make appropriate keyboard entries to control the displays. Each display is updated every 10 seconds.

II. Telemetry Status Display

The telemetry status display format is shown in Fig. 1. A line is devoted to each telemetry stream. Each stream is uniquely defined by the first five columns of the display:

DSS: Deep Space Station.

SC: Spacecraft number.

UDT: User data type number, identifies telemetry data and processor.

DDT: Data-dependent type number, identifies telemetry channel number and bit rate range.

GDD: Gross data descriptor, identifies data as real-time or playback from tape.

Up to eight lines are accommodated on the display. If more streams are present, the identifiers are displayed in turn on the tenth line with the indicator OTHERS. If the operator is interested in one of these, he can delete a currently displayed stream to make room for it.

For each stream displayed, the general status is displayed in the next three columns:

SYNC: Status of frame sync. This is the result of processing to assure the quality of the data stream by verifying the frame sync. This indicator has four states:

- (1) Slash (/) indicates successful sync is achieved and maintained.
- (2) Asterisk (*) indicates failure to sync.
- (3) Blank indicates no data have yet been received.
- (4) Zero (0) indicates that the frame sync algorithm is not active, either because it has been deleted by the operator or because data have stopped.

COUNT: This is the count of frames that have been received since sync was most recently acquired. When frame sync is lost, the count remains unchanged; when sync is reacquired, the count is restarted at zero. The size of the count, therefore, indicates to the operator the general stability and quality of the data stream.

ALARM: The alarm field has five possible values:

- (1) Slash (/) indicates there are no time tag errors or data outages for the indicated stream
- (2) TIME ERR indicates that the difference between the time tags on consecutive data blocks is not within 2% of the expected interval and cannot be explained by the block sequence numbers. The flag indicates a faulty time tag and is maintained for at least one display update (10 seconds).

- (3) MISG DATA indicates that some data (at least one block) were missed. If the data are no longer being received for this stream, the alarm will persist. If, however, there is merely a gap, as indicated by block sequence numbers and time tags, the alarm will be removed when the data resume.
- (4) DELETED indicates that the row has been deleted by operator input. This alarm persists until the row is released or reassigned by a subsequent operator input.
- (5) OTHERS appears in row 10 only and indicates that one and possibly several streams of data are being received but not processed if the DSS through GDD fields are filled. If they are blank, no other streams are being received.

III. Telemetry Analysis Display

The telemetry analysis display format is shown in Fig. 2. This display contains data related to a single stream. Any of the streams on the status display can be selected. The data are derived or extracted from the high-speed data blocks. The fields are described as follows:

- (1) DDD:HH:MM:SS (FMT): The time (GMT) the display was formatted.
- (2) DDD:HH:MM:SS: (DATA): The time (GMT) of the block from which the data below are determined.
- (3) DSS through GDD: The stream identifiers defined in the status display.
- (4) FSIZE: The frame size in bits.
- (5) TIME TAG ERROR: The time tag error count, i.e., the number of time tag errors that have occurred since the stream was assigned. This can be reset to zero by operator input.
- (6) PN ERR: Pseudonoise (PN) frame sync errors allowed indicate the number of bit errors allowed for sync acquisition and maintenance.
- (7) FR SYNC: Indicates the state of the frame sync process.
 - (a) Slash (/) indicates in sync.
 - (b) Asterisk (*) indicates out of sync.
 - (c) Zero indicates that the processor is not attempting to sync on the data (see the telemetry status format description).
 - (d) Blank indicates that not enough data have been received to make any sync determination.

- (8) FR COUNT: The number of frames since sync was last acquired.
 - (9) RX: The receiver number and status (slash is in lock, asterisk is out of lock).
 - (10) SDA: The Subcarrier Demodulator Assembly (SDA) is similar to the receiver indication.
 - (11) SSA: The Symbol Synchronizer Assembly (SSA) fields may be a number and lock status, NA if not applicable or double asterisk (**) if an invalid number is received.
 - (12) BDA: The Block Decoder Assembly (BDA) is OFF, or ON with status (slash or asterisk for in or out of lock).
 - (13) DDA: The Data Decoder Assembly (DDA) is similar to the SSA.
 - (14) BIT SYNC: Bit sync is OFF or INT with lock status.
 - (15) TCP: The number of the Telemetry Command Processor (TCP) in use as 1, 2, or 3 or asterisk (*) if an invalid number is received.
 - (16) AGC and SNR: Both the Automatic Gain Control (AGC) and Signal-to-Noise Ratio (SNR) are extracted directly from the data block and displayed in decimal format. The AGC has a negative sign and the SNR can have either a positive or negative sign.
 - (17) BITRATE: The bit rate is deduced from the DDT and S/C.
- Fields 18–20 relate to data extracted from the telemetry frame. The selection is made by operator input.
- (18) DN LOC: The data number location (DN LOC) is the location in bits from the start of the sync code to the beginning of the extracted data.
 - (19) DN LGTH: The length in bits of the extracted data. Up to 33 bits may be selected.
 - (20) DN: The data number in octal representation of the extracted data.

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DDD:HH:MM:SS TELEMETRY STATUS FORMAT
DSS SC UDT/DDT GDD SYNC COUNT ALARM
NN NN NNN/NNN N / NNNN /
NN NN NNN/NNN N * 1301 TIME ERR
NN NN NNN/NNN N / NNNN /
NN NN NNN/NNN N * 1234 MSG DATA
NN NN NNN/NNN N / NNNN /
NN NN NNN/NNN N / 0015 /
NN NN NNN/NNN N / NNNN /
      /
      /
NN NN NNN/NNN N OTHERS

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Fig. 1. Telemetry status display format

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DDD:HH:MM:SS FMT TELEMETRY ANALYSIS
DDD:HH:MM:SS DATA FORMAT
DSS SC UDT/DDT GDD FSIZE
NN NN NNN/NNN N NNNN
TIME TAG PN ERR FR FR
ERROR ALLWD SYNC COUNT
NN NN/NN / NNN
BIT
RX SDA SSA BDA DDA SYNC TOP
N/ N/ N/ XXX/ N/ XXX/ N
AGC BIT RATE SNR
- NNN.NN NNNN.NNX NN.NN
SPACECRAFT
DN LOC DN LGTH DN
NNNN NN NNNNN

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Fig. 2. Telemetry analysis display format